Vol. 39, pp. 1–6 February 23, 1926

PROCEEDINGS
OF THE
BIOLOGICAL SOCIETY OF WASHINGTON

RACES OR SUB-SPECIES IN RETICULITERMES.

By THOS. E. SNYDER.

Races or sub-species of the termites *Reticulitermes lucifugus* Rossi and *flavipes* Kollar have recently been discovered in France by Dr. J. Feytaud (1924) and in the United States by N. Banks and T. E. Snyder; they are not merely variants but have composite characters. While these two termites occur in both Europe and the United States, *flavipes* has a wider distribution in North America than in Europe, whereas *lucifugus* has a broad dispersal throughout Mediterranean Europe and North Africa, but in the United States occurs only near Boston, Mass. It is quite probable that *lucifugus* is native to Mediterranean Europe, from where (Italy) it was described in 1792 and was introduced to the United States in the vicinity of the Arnold Arboretum. The original habitat of *flavipes*, however, is not definitely known; it was described at a later date than was *lucifugus*, namely, in 1837, from the Imperial hothouses at Schönbrunn near Vienna, Austria.

Dr. Feytaud kindly sent specimens of the variant occurring in France to Mr. Banks for comparison with *flavipes;* Feytaud notes in 1924 the differences between the typical *lucifugus* and this variant, presumably the termite, which under the name of *lucifugus*, caused great damage, between 1840 and 1850, in the villages of the Charente-Inférieure.

To further summarize briefly the morphological differences, the sub-species now occurring in the Department of Charente-Inférieure, France, has a lighter colored head than the typical *lucifugus* (as has *flavipes*). The wings are less smoky, with costal area lighter colored, the tibiae are lighter colored and the ocellus is separated from the eye by a distance equal to the long diameter of an ocellus (not quite as far as in *flavipes*),

whereas in *lucifugus* this distance is less than the diameter of an ocellus. In length this variant is shorter than is *lucifugus*, as is *flavipes;* the length of the forewing is greater than in either *flavipes* or in the variant in the United States from Arkansas; the forewing is not as broad as in *lucifugus*. In the typical *flavipes*, the forewing is shorter and narrower than in the typical *lucifugus*.

The sub-species, occurring in Arkansas, U. S. A., has the wings more cloudy than in *flavipes*, with costal area darker, the ocellus is separated from the eyes by a distance less than the diameter of an ocellus. The length of this variant is less than that of *lucifugus* but is slightly greater than that of *flavipes;* the width of the forewing is slightly greater than in *flavipes*.

Both *lucifugus* and *flavipes* are common and destructive termites; their ravages rank them insects of considerable economic importance. Unfortunately their life history or biology is but imperfectly known. Detailed, thorough investigations by many more students are needed. Fundamental principles of great importance and broad application are involved in the biology of these termites. Possibly evidence will be obtained as to the evolution of species.

The presence of races of these species of *Reticulitermes* renders it necessary to discover the original home of *flavipes*. As early as 1896 Dr. E. A. Schwarz of this Bureau stated that he believed that a study of the inquilines or guests of a termite occurring in both Europe and the United States might reveal to which country it was native. Introduced insects, as a rule, do not carry their normal parasites or inquilines with them into the country in which they become established. Such a cooperative study of inquilines between European and American entomologists should be made.

Certain fungus parasites attack both *lucifugus* and *flavipes;* these fungi—species of *Termitaria*—described in 1920 by Dr. Roland Thaxter of Harvard University, may aid in establishing native habitats.

Furthermore, parasitic intestinal protozoa occur in both termites. Dr. M. M. Metcalf of the Johns Hopkins University believes that a study of the protozoa from living termites might prove helpful in studies of geographical distribution, habitat and relationships. Already important investigations of these

living protozoa have been made by Dr. L. R. Cleveland of the Johns Hopkins University, Prof. S. F. Light of the University of California and Dr. Harold Kirby, Jr., of Yale University. Study of the protozoa of the races and experiments on the transfer of protozoa from one species to another should yield results.

More profound studies of the biology of *lucifugus* and *flavipes* may reveal that there is a crossbreeding between species—two in Europe and eight species of *Reticulitermes* in the United States—leading to the production of hybrids. Or interbreeding between the different types of reproductive forms *within the species* might produce variation in the progeny. Such interbreeding is not rare in nature.

A summary of our knowledge of the species of *Reticulitermes* now becomes necessary as a preliminary to further discussion.

Reticulitermes is considered by N. Holmgren to be a subgenus of the genus *Leucotermes*, which was established by Silvestri in 1901, with the species *tenuis* Hagen as genotype; this species was described in 1858, type locality Brazil. Fourteen species of *Leucotermes* Holmgren (sens. strict.) are included, the winged adults of which are light colored, with the wings only slightly reticulated but strongly hairy, ocelli not always present, pubescence dense, and are night flying. The soldiers have the mandibles more slender, elongate and straighter than in species of *Reticulitermes*. Species of *Leucotermes* have a more southern distribution — namely, 1 Nearctic, 6 Neotropical, 4 Oriental and 4 Australian species.

1858. *Leucotermes tenuis* Hagen. Antilles, Central and South America.
1896. *Leucotermes ferox* Froggatt. Australia.
1896? *Leucotermes platycephalus* Froggatt. Australia.
1898. *Leucotermes tenuior* Haviland. Borneo (Sarawak).
1900. *Leucotermes ceylonicus* Holmgren. Ceylon.
1902. *Leucotermes indicola* Wasmann. India (Bombay).
1902. *Leucotermes insularis* Wasmann. Cocos Island.
1915. *Leucotermes validus* Hill. Australia (Northern Territory).
1920. *Leucotermes aureus* Snyder. Arizona, U. S.
1921. *Leucotermes philippinensis* Light. Philippines.
1922. *Leucotermes clarki* Hill. W. Australia.
1924. *Leucotermes cardini* Snyder. Antilles.
1924. *Leucotermes convexinotatus* Snyder. Antilles and Central America.
1924. *Leucotermes longiceps* Snyder. Brazil.
1925. *Leucotermes crinitus* Emerson. British Guiana.

Species of *Leucotermes* occurring as fossils are *meadii* Scudder from Miocene shale, Florissant, Colorado, United States, and *hartungi* Heer from upper Miocene, Oeningen, Baden, Germany.

As a subgenus of *Leucotermes*, Holmgren in 1913 established *Reticulitermes*. "*Termes*" *flavipes*, described by Kollar in 1837, is the genotype;

type locality the Imperial greenhouses at Schönbrunn near Vienna, Austria. Fourteen species have been described; the winged adults are dark colored, with wings strongly reticulate but with few hairs, ocelli always present, pubescence not dense, and are day flying. The soldiers have the mandibles S-shaped and shorter than in species of *Leucotermes*. Species of Reticulitermes are of a relatively northern distribution; there are 2 Palearctic, 8–10 Nearctic (including 2 Palearctic species) and 4 Oriental (temperate) species, namely,

1792. *Reticulitermes lucifugus* Rossi. Mediterranean Europa, North Africa and United States.
1837. *Reticulitermes flavipes* Kollar. Europe, Eastern United States and Mexico.
1885. *Reticulitermes speratus* Kolbe. Japan.
1907. *Reticulitermes virginicus* Banks. Southeastern United States.
1912. *Reticulitermes flaviceps* Oshima. Japan (Formosa).
1920. *Reticulitermes claripennis* Banks. Texas, Kansas, Arizona (U. S.) and Mexico.
1920. *Reticulitermes hageni* Banks. Southeastern United States.
1920. *Reticulitermes hesperus* Banks. Pacific Coast, United States.
1920. *Reticulitermes hoferi* Banks. Arizona (U. S.).
1920. *Reticulitermes humilis* Banks. Arizona (U. S.).
1920. *Reticulitermes tibialis* Banks. Western United States.
1920. *Reticulitermes tumiceps* Banks. Arizona and Utah (U. S.).
1923. *Reticulitermes chinensis* Snyder. Suifu, Szechwan, China.
1924. *Reticulitermes fukiensis* Light. Fuchow, Fukien, China.

In Baltic Sea amber occur *Reticulitermes antiquus* Germar, *borusicus* Von Rosen and *robustus* Von Rosen; this deposit being either upper Eocene or lower Oligocene in geological age.

To summarize, there are 29 living species of *Leucotermes* Silvestri (sens. lat.), 15 being in *Leucotermes* Holmgren (sens. strict.) and 14 in *Reticulitermes* Holmgren; in addition there are 2 fossil species of *Leucotermes* and 3 fossil *Reticulitermes*. These termites are distributed throughout the world as follows:

Leucotermes Holmgren (sens. strict.).

	Palearctic	*Nearctic*	*Neotropical*	*Oriental*	*Australian*	
Living	0	1	6	4	4	
Fossil	1	1	0	0	0	
Total	1	2	6	4	4	17

Reticulitermes Holmgren.

Living	2	8	0	4	0	
Fossil	3	0	0	0	0	
Total	5	8	0	4	0	17
Grand total	6	10	6	8	4	34

While these data indicate that the subgenus *Reticulitermes* is widely distributed and ancient, the largest number of living species occur in North America and hence North America is at present the center of distribution. However, in Europe 3 fossil species occur as early as the Oligocene, whereas no fossil species that can be placed in *Reticulitermes* have been found in the United States.

In this connection Feytaud's discovery that under the name *R. lucifugus* Rossi two distinct species or at least two distinct races exist in France is extremely interesting. One of these races is close to *flavipes* morphologically and the other the typical *lucifugus* of Italy.

Then later, an Italian entomologist, C. Jucci, in 1925 states that he believes that there are in addition marked differences in the biology of these two races. The *flavipes* type is able to attack living trees and new colonies being formed by winged swarming adults; the other, the true *lucifugus*, lives only in dead wood and forming new colonies by non-winged reproductive adults, as in Italy. In the United States two morphologically distinct races of *flavipes* occur, one occurring in Illinois and Arkansas being morphologically similar to the European *lucifugus* and the other the typical *flavipes*. However, as yet, no biological differences have been discovered between these two races of *flavipes* in the United States; the typical *flavipes* infests both living and dead trees. This apparent lack of biological difference may merely be due to incomplete knowledge.

Again in Texas, there has been found, outside of the normal range of *R. hageni* Banks, a morphological variety of *hageni* that may prove to be a sub-species. At present there are insufficient specimens to enable definite conclusions to be drawn.

Conclusions.

It may eventually be proven that new species of *Reticulitermes* are being evolved, i. e., there are now nascent species. Certain species are very close morphologically and races or sub-species exist with composite characters; close species may be merely variations! Or termites being plastic, there is a tendency toward a mean, and in reality there are no sub-species. Here is an excellent opportunity for cooperation between entomologists of Europe and America to establish (1) the original habitat of *flavipes*, whether from Mexico, the United States or Europe; (2) whether there is cross-breeding between species and the consequent production of hybrids; (3) whether interbreeding between the different reproductive types within the species—which occurs in nature, but which we (Snyder, 1920, 1925) have not been able to promote artificially in glass breeding cages—may result in progeny differing from the normal. Dr. L. R. Cleveland in 1924 succeeded in obtaining eggs from the crossing of macropterous female and brachypterous male adults but was not able to rear these, due, it is believed, only to unfavorable conditions in the cages. Methods of collecting, rearing and breeding termites are discussed in another paper. It is hoped that others will become interested in this important problem in the genetics of termites and the biology and evolution of the termite castes.

LITERATURE CITED.

1920. Banks, N. and Snyder, T. E. Revision of Nearctic Termites. Bull. 108, U. S. National Museum, April 13, pp. 1–228 (List of inquilines of termites in the United States).

1918. Dobson, R. J. A European termite *Reticulitermes lucifugus* Rossi in the vicinity of Boston. Psyche, Vol. 25, no. 5, October.

1924. Feytaud, J. Le Termite de Saintonge. C. R. Acad. des Scis. Seance 7, Jan., pp. 241–244.

1925. Jucci, Carlo. Il problema dei reali veri del *Reticulitermes lucifugus*. Boll. della Soc. Ent. Ital. anno. LVII, n. 7, Lugio 31, Genova.

1896. Schwarz, E. A. Termitidae observed in southwestern Texas in 1895. Proc. Ent. Soc. Wash., Vol. 4, no. 1, Nov. 5, pp. 38–42. (*No* inquilines found with *R. lucifugus* in Europe.)

1920. Snyder, T. E. The Colonizing Reproductive Adults of Termites. Proc. Ent. Soc. Wash., Vol. 22, no. 6, June, pp. 109–150.

1925. Snyder, T. E. The Origin of the Castes in Termites. Proc. Biol. Soc. Wash., Vol. 38, May 26, pp. 57–68.

1920. Thaxter, R. Second Note on Certain Peculiar Fungus—Parasites of Living Insects. The Botanical Gazette, Vol. LXIX, no. 1, pp. 1–27, January.